



Guidance for Preparing Project Assessment and Evaluation Plans (PAEPs)

2007-2008

As part of the grant agreement, all State Water Resources Control Board (State Water Board) grant recipients will prepare a Project Assessment and Evaluation Plan (PAEP) at the initiation of their project to summarize how project performance will be assessed, evaluated, and reported.

The goals of a PAEP are as follows:

- To provide a framework for assessment and evaluation of project performance.
- To identify measures that can be used to monitor progress towards achieving project goals.
- Provide a tool for grant recipients and grant managers to monitor and measure project progress and guide final project performance reporting that will fulfill grant agreement requirements.
- To provide information to help improve current and future projects.
- To maximize the value of public expenditures to achieve environmental results.

The attached outline and guidance (Attachments 1 through 7) provides assistance to grant recipients preparing and implementing a PAEP. It is a practical guide for evaluation of project performance. The information in this guidance should prepare you to design and carry out a PAEP, provide you with tools to track project progress, and link progress with desired outcomes. It could also help you identify any necessary adjustments within the constraints of your allocated budget during the course of the project and facilitate final report preparation.

We realize that the State Water Board grant recipients come in all shapes and sizes. Some recipient organizations have full-time staff and annual budgets exceeding \$1,000,000; others have far smaller budgets and rely almost entirely on volunteers. Recipient organizations also range widely in their goals—from providing technical assistance and enhancing public awareness, to delivering water for drinking and irrigation, to researching new management practices or monitoring water quality.

Likewise, the activities being supported by the State Water Board funds are very diverse, so PAEPs will need to identify performance measures or indicators that best fit the needs of a particular project and the associated activities. In most cases, the identification of several measures will be necessary to evaluate project performance. For example, the success of education and outreach activities can be evaluated through

measuring increased community awareness or the level of participation in volunteer monitoring and knowledge of watershed functions. Implementation of Best Management Practices (BMPs) can be evaluated based on water quality measurements, response of [bioindicators](#), changes in physical characteristics of in-stream habitat conditions, calculated pollutant load reductions, and the number of acres treated. Habitat restoration activities can be evaluated based on acres of wetlands restored, number of off-site causes of bank and bed erosion treated, or feet of stream channel stabilized, as documented with before and after photographs, and/or digitized data layers showing change in the extent or quality of habitat. Projects designed to achieve multiple objectives and create synergies by integrating flood management, water quality protection, water supply reliability and enhancement, and habitat protection/restoration activities will require performance measures that relate to all objectives the project is designed to address.

PAEP Outline and Guidance

The PAEP outline ([Attachment 1](#)) and template table ([Attachment 2](#)) provide guidance that you can put to use now to implement your project and ensure that your desired outcomes can be achieved. The narrative portion of the plan outline, I. Project Summary and II. Project Goals and Desired Outcomes, can be completed using information presented in your proposal and executed agreement. The tables are road maps you can use to chart the course of your project activities and measure how far you have gone in achieving your project goals and desired outcomes.

The PAEP groups project activities into five major categories. These categories are 1) Planning, Research, Monitoring, and Assessment, 2) Education, Outreach, and Capacity-building, 3) Habitat Restoration, 4) Load Reduction 5) Water Conservation, Supply Reliability Enhancement, and Recycling, and 6.) Flood Attenuation and Floodplain Protection. These categories allow you to assemble and organize activities with similar attributes, and evaluate them using a set of performance measures or indicators common to each category. Additional information on appropriate categories for different project activities can be found in [Attachment 3](#). Many grant projects implement multiple activities in more than one category, and Integrated Regional Water Management projects, in particular, are required by design to achieve multiple objectives on a watershed or river basin scale. This system of categories should help simplify the organization of your plan and choice of appropriate indicators for evaluation. The tables present examples of hypothetical projects in each of the five main activity categories. The tables are organized to provide for a simple and concise description of:

- Project goals;
- Desired project outcomes;
- Appropriate project [performance measures](#) which include: 1) [Output Indicators](#) *representing* measures to efficiently track outputs (activities, products (including capital investments, or deliverables) and 2) [Outcome Indicators](#), measures to evaluate change that is a direct result of your work and can be linked through a weight-of-evidence approach to your project activities or outputs (e.g. improvements in achieving or restoring multiple beneficial uses, environmental conditions, awareness, participation, or community, landowner, or local government capacity);

- Methods of measurement or tools you will use to document your project performance (e.g. California Rapid Assessment Method, California Department of Fish and Game Monitoring Protocols for fisheries restoration projects); and
- Measurable [targets](#) that you think are feasible to meet during the project period, such as a 10% increase in community awareness, 90% reduction in invasive species acreage, 50% reduction in pesticide use within your watershed, or a 10% increase in water use efficiency that decreases groundwater use and overdraft.

The list of Core Outcome Indicators ([Attachment 4](#)) should be used as a starting point for identifying appropriate project indicators based on your activity categories.

[Attachment 5](#) includes some example PAEP's and supporting documents used to develop the PAEP's. These may be helpful for efficiently developing your project PAEP. The example tables in [Attachment 5](#) include performance measures that are for illustration purposes only. They are intended to show the linkages between project goals, desired outcomes, the types of "output" indicators (activities and interim products), and the types of "outcome" indicators (environmental results and increases in watershed stewardship capacity), that could be used in the overall performance evaluation process. Specific indicators will vary based on project activities and goals and should be derived from those sections in your original proposal that describe the metrics or habitat attributes you intend to collect or document during your project.

[Attachment 6](#) and [Attachment 7](#) include and provide access to additional project performance measurement information that can be used to guide your plan development and implementation.

Project Assessment and Evaluation Plan (PAEP) Outline

I. Project Summary

- A. Funding Program: *Identify the program that will be used to fund your grant project contract or agreement. For Example, Proposition 40 Integrated Watershed Management Program, Proposition 50 Agricultural Water Quality Grant Program or Proposition 50 Integrated Regional Water Management Program. This funding source will be identified in your contract or agreement.*
- B. Project Description: *Provide a summary of the project. This can be a condensed version of the narrative presented in your proposal and/or agreement.*
- C. Problem Statement: *Briefly discuss the environmental issues or problems facing the watershed in which this project will take place. Identify which problems or issues you will address with the project. This information can be taken from your proposal and/or agreement. You can also combine this section with 'B. Project Description', above, if you find it provides a more concise discussion. Depending on the grant funding program, you may also be required to address the following points:*
 - i. *Identify or characterize baseline data*
 - ii. *Identify pollution source categories*
 - iii. *Identify and describe current restoration activities; BMPs; load reduction activities; prevention activities*
 - iv. *Describe the manner in which the proposed best management practices or management measures will be implemented*
 - v. *Summarize how the effectiveness of the proposed practices or measures in preventing or reducing pollution will be determined*
 - vi. *Determine "changes in flow pattern" in affected water bodies.*
 - vii. *Determine economic benefits of implementing the project.*
- D. Project Activities or Tasks: *Provide a list of the project activities or tasks that you will undertake to address the issues or problems. (These should be taken from your proposal, agreement or, contract depending on which grant program is providing funds to your project and at what stage you are in the program.)*
- E. Category of Project Activities or Tasks: *Indicate which of the following categories your activities correspond to.*
 - 1) *Planning, Research, Monitoring and Assessment*
 - 2) *Education, Outreach, and Capacity -building*
 - 3) *Habitat Restoration*
 - 4) *Pollutant Load Reduction*

- 5) *Water Conservation, Reliability Enhancement, and Recycling*
- 6) *Flood Attenuation and Flood Protection*

Each activity should correspond to only one category. You may however, have more than one activity corresponding to a given category. This will be useful for preparing your Project Performance Measures Table(s) in item III below. In these tables, assessment and evaluation of project performance is differentiated based on categories of activities that will be implemented. These categories conveniently provide common sets of measures and methods or tools for measurement that you may pick from for your project. More detail and resources for identification of these project performance measures is provided below and attached for reference.

II. Project Goals & Desired Outcomes

Describe the goals of your project and state the desired outcomes in qualitative terms (e.g.: Goal: Implement TMDL plan for reducing toxicity by increasing landowner participation in BMP implementation. Desired Outcomes: Reduce pesticide application rates in watershed; reduce the number of toxic samples; increase benthic macroinvertebrate species diversity). This information should be used to guide completion of your Project Performance Measures Table(s) in item III below.

III. Project Performance Measures Tables

A Project Performance Measures Table should be completed for each category of activities identified for your project in item I. E above. Each of your project activities in a specific category must be listed in a corresponding table for that category. The attached tables contain examples of the kinds of performance measures or indicators, measurement tools, and targets that might apply to the five general activity categories. These tables are for illustrative purposes only and should be used to guide the identification of appropriate performance measures for your project. Use the following guidance when completing tables for your project:

<i>Project Goals:</i>	<i>Identify the project goals as they relate to activities or items outlined in the grant proposal or agreement</i>
<i>Desired Outcomes:</i>	<i>Identify measurable results you expect to achieve by implementing project activities consistent with the specified goals</i>
<i>Output Indicators:</i>	<i>Identify the indicators for specific activities that will be used to track progress towards achieving the project goal and desired outcome</i>
<i>Outcome Indicators:</i>	<i>Identify the indicators that will be used to measure effectiveness in achieving the desired outcomes or results</i>
<i>Measurement Tools and Methods:</i>	<i>Identify the proposed tools and methods used in documenting performance (examples of tools and methods are listed in Attachment 4 and 5)</i>
<i>Targets:</i>	<i>Identify targets or benchmarks against which you can measure success (most targets will be quantitative, such</i>

as % reduction in pesticide use or % increase in community awareness; however, some targets will be qualitative, such as “broad acceptance of peer-reviewed monitoring plan,” or “adopted conceptual model hypothesizing cause-and-effect relationships.

Table 1
Type Category Here
TYPE PROJECT TITLE HERE

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
1. Who, what, by when, & how?	<p>1. What do you want by the end of your project?</p> <p>The desired outcome should be achievable, measurable, and as tangible as possible.</p> <p>The desired outcome should be able to be met by reaching your goal stated.</p> <p>However, you may have multiple desired outcomes per goal.</p>	<p>1. <u>What things will be produced</u> as a result of working toward your goal?</p> <p>And what are your measurement units for <u>measuring these things produced</u>?</p> <p>The units should be general quantitative units of <u>output</u>.</p> <p>Output Indicators can be an indirect measure of your goal.</p>	<p>1. What quality, social behavioral or environmental condition, will be <u>changed</u> to indicate that the goal will be met?</p> <p>And what are the general measurement units for <u>measuring these changes</u>?</p> <p>Outcome Indicators should be units to measure your goal directly.</p>	<p>1. <u>Tools</u>- What will you use as a ruler to measure the target?</p> <p>2. <u>Methods</u>-</p> <p>-What is the name of the scientific method being used?</p> <p>-Can it be sited from somewhere or explained?</p> <p>-Will it be in your QAPP or Monitoring Plan?</p>	<p>1. What is the specific measurement you would like to reach by the end of your goal deadline, that will indicate you have reached your desired outcome?</p> <p><i>Note: The measurement units should match the measurement units stated in the <u>Outcome Indicator Column</u>, & be measured using the tool & method stated in the <u>Measurement Tools & Methods column</u>.</i></p> <p>There may be multiple targets for each goal & desired outcome.</p>
2. Who, what, by when, & how?	<p>1. What do you want by the end of your project?</p> <p>The desired outcome should be achievable, measurable, and as tangible as possible.</p> <p>The desired outcome should be able to be met by reaching your goal stated.</p> <p>However, you may have multiple desired outcomes per goal</p>	<p>1. <u>What things will be produced</u> as a result of working toward your goal?</p> <p>And what are your measurement units for <u>measuring these things produced</u>?</p> <p>The units should be general quantitative units of <u>output</u>.</p> <p>Output Indicators can be an indirect measure of your goal.</p>	<p>1. What quality, social behavioral or environmental condition, will be <u>changed</u> to indicate that the goal will be met?</p> <p>And what are the general measurement units for <u>measuring these changes</u>?</p> <p>Outcome Indicators should be units to measure your goal directly.</p>	<p>1. <u>Tools</u>- What will you use as a ruler to measure the target?</p> <p>2. <u>Methods</u></p> <p>-What is the name of the scientific method being used?</p> <p>-Can it be sited from somewhere or explained?</p> <p>-Will it be in your QAPP or Monitoring Plan?</p>	<p>1. What is the specific measurement you would like to reach by the end of your goal deadline, that will indicate you have reached your desired outcome?</p> <p><i>Note: The measurement units should match the measurement units stated in the <u>Outcome Indicator Column</u>, & be measured using the tool & method stated in the <u>Measurement Tools & Methods column</u>.</i></p> <p>There may be multiple targets for each goal & desired outcome.</p>

Revised Project Activity Categories

The Project Assessment and Evaluation Plan (PAEP) groups activities into six major categories. They are:

- **Planning, Research, and Assessment**
- **Education, Outreach, and Capacity-Building**
- **Habitat Restoration**
- **Pollutant Load Reduction**
- **Water Conservation, Supply Reliability Enhancement, and Recycling**
- **Flood Attenuation and Floodplain Protection**

Planning, Research, and Assessment includes activities that precede implementation of pollution prevention and reduction practices, restoration of habitat and watershed processes and functions (e.g., groundwater recharge, storm water conveyance, sediment transport), implementation of education and outreach activities, and integrated projects with multiple benefits. Planning, research, and assessment activities can include development of analytical methods for detection of sub-lethal adverse effects on aquatic organisms, testing of alternative hypotheses related to pollutant transport mechanisms or watershed functions, development and application of land use and mitigation forecasting models and other scenario-planning tools, development of quantifiable goals or benchmarks related to habitat protection, in-stream flow requirements, species recovery, or pollutant assimilative capacity, development of digital maps for geospatial analysis of impairment risks, and relating location of investments with beneficial use improvements. Activities in this category may also include characterization and assessment of watershed conditions, impairment assessment, analyses of limiting factors to beneficial use recovery, and linking management responses to improvements in watershed conditions.

Education, Outreach, and Capacity-Building includes activities that are primarily designed to increase awareness about human activities that contribute to beneficial use impairment and to change behavior in such a way that human-induced stressors on aquatic organisms or watershed processes and functions are reduced below critical threshold levels. They may include workshops for local elected officials and other land use decision-makers, building technical expertise and providing guidance in the preparation of Farm Plans, supporting under-represented communities to participate in decision-making and providing access to complex and technical information.

Habitat Restoration includes activities that directly improve the physical or biological condition of a water body, stream reach, or watershed area or restore critical landscape features essential for the maintenance of aquatic habitat and organisms dependent on it.

Pollutant Load Reduction includes activities that directly contribute to preventing or reducing quantifiable amounts of pollutants from entering waterbodies and aquatic food webs and are usually associated with Total Maximum Daily Load implementation plans or elements of comprehensive watershed management plans.

Water Conservation, Water Supply Reliability Enhancement, and Recycling includes activities that reduce reliance on imported water supplies, directly or indirectly restore in-stream flows for protection and restoration of aquatic life uses, develop

required local policies, funding mechanisms, and infrastructure for beneficial re-use of water for irrigation, seawater intrusion prevention and remediation, and other purposes, and enhance storm water runoff infiltration and groundwater recharge.

Flood Attenuation and Floodplain Protection includes activities that (1) provide resilience to the effects of climate change, (2) enhance and protect groundwater recharge and storage functions of floodplains, (3) protect floodplain functions as wildlife and fish migration corridors and rearing habitat, and supporting riparian habitat, (4) contribute to reductions in flood peaks and flooding impacts. Projects in this category may also include application of Low-Impact Development (LID) techniques which mimic the natural hydrologic functions of a watershed to reduce the rate, volume and pollutant loading of runoff and impairment of aquatic life uses due to increased runoff rates, stream bed and bank erosion, and resulting in-stream habitat degradation. Examples of LID projects are vegetated bioretention swales, amending soil to retain runoff, tree-box filters, and other natural treatment systems. Projects could also include preservation of open space, which allows for natural recharge to occur across a large area. Projects which retain and infiltrate water onsite can also have economic benefits in terms of reduced end-of-pipe treatment or irrigation costs.

Revised List of “Core Outcome Indicators”

The following is a list of core outcome indicators that should guide the development of your Project Assessment and Evaluation Plan for State Water Board loans and grant-funded projects. The purpose of this core list is to provide a menu of outcome indicators that can be used to guide selection of indicators for your specific project. General review of these core indicators should help you recognize which ones are appropriate for quantifying the outcomes of your project activities. This is not a comprehensive list. You may find that you can use one or more of these indicators to measure performance of your activities. In some cases you will need to develop more specific indicators for your activities. For example, in one project, anthropogenic stressors and limiting factors to beneficial use recovery may be primarily due to specific pollutants, while in other projects, the stressors may be hydromodification or flow diversions. In any case, outcome indicators for the specific stressor(s) will have to be identified that enable you to compare environmental conditions before and after you implemented your project (e.g., indicators associated with pesticide toxicity or with altered flood peaks and timing, respectively).

A. Planning, Research, and Assessment

1. Number of characterized watershed land cover/land use categories
2. Number and magnitude of anthropogenic stressors identified (including extent of hydromodification; known and suspected pollution source categories)
3. Peer-reviewed and adopted watershed assessment report or watershed management plan
4. Peer-reviewed and adopted long-term Monitoring Plan for TMDL or Nonpoint Source Program implementation
5. Peer-reviewed and adopted long-term Restoration Plan for beneficial use recovery
6. Adopted list of watershed-specific BMPs and restoration practices
7. Adopted conceptual models outlining hypothesized cause-effect relationships
8. Peer-reviewed and adopted limiting factors analysis
9. Peer reviewed and adopted source analysis
10. Adopted analytical methods, bioassays, or tests
11. Calibrated and validated forecasting models
12. % of groundwater recharge areas, riparian and other critical habitat, routed drainage network, etc. mapped in watershed or drainage basin

B. Education, Outreach, and Capacity-building

1. % increase in community awareness
2. % increase in community participation in watershed stewardship activities
3. % increase in local government expertise, resources, and management tools (e.g. GIS capacity; SOPs; public-private partnership agreements; sustained funding sources for watershed health maintenance; building codes aligned with watershed goals, etc.)
4. % increase in landowners trained and certified in BMP implementation
5. % of cities and counties within watershed, drainage basin, or project area having adopted the Ahwahnee Principles

C. Habitat Restoration

1. % increase in native habitat extent
2. % decrease in invasive species cover
3. Improvement in habitat condition or other biometric scores (e.g. CRAM, IBI)
4. % increase in sustained habitat maintenance and management agreements
5. % increase in watershed functions and processes resembling reference conditions

D. Pollutant Load Reduction

1. Estimated or directly measured mass of a specific pollutant that BMP implementation prevented from reaching surface or groundwater (required for 319(h)-funded projects)
2. Reductions in peak flow or total runoff
3. % decrease in pollutant use and/or discharge
4. % increase in certified practices designed to result in reduction of pollutant inputs into listed water bodies
5. % increase in benthic macroinvertebrate diversity
6. % decrease in adverse effects biomarkers and targeted toxic samples (event-based water toxicity; sediment toxicity)
7. Reduction in event mean concentrations before and after BMP implementation
8. Volume of runoff treated by structural BMPs compared to average runoff volume in project area

E. Water Conservation, Reliability Enhancement, and Recycling

1. % increase in recycled water use in watershed or project area
2. % of groundwater recharge areas restored and/or protected in watershed or project area
3. % decrease in acre-feet lost through accelerated runoff due to increases in effective drainage density and connectivity
4. % anticipated reduction in water use by county, city, or project area based on adopted water conservation measures by jurisdiction within project area
5. Number of retrofits implemented to enhance reservoir management flexibility for multiple objectives
6. Acre-feet of subsurface storage increase in project area
7. Volume of contaminated groundwater basins cleaned up
8. % reduction in subsidence rates due to groundwater overdraft mitigation
9. Increase in water availability for environmental restoration and enhancement

F. Flood Attenuation and Floodplain Protection

1. Number of floodplain acres protected from urban encroachment
2. Miles of connected drainage reduced
3. Acres of wetlands restored in watershed or project area
4. Number of flood attenuation BMPs implemented
5. Number of cities and counties within watershed, drainage basin, or project area with state-of-the-art building codes and land use ordinances with flood attenuation requirements (e.g. runoff retention, on-site storage and dry-season use, use of pervious pavement, infiltration enhancements, etc.)
6. Dredging and floodway maintenance costs avoided by integrated land use and water management decisions

Prototype Project Assessment and Evaluation Plan
Planning, Research, Monitoring and Assessment

Identification of Effective Restoration and Land Management Measures in the Mill Creek Watershed

I. Project Summary

A. Funding Program

The Project is supported by Proposition 40 as part of the Agricultural Water Quality Grant Program and local and federal matching funds.

B. Project Description

Sediment is one of the pollutants that is impairing aquatic life uses in Mill Creek and all of its tributaries and has been on the 303(d) list since the mid-1980s. Sources of excessive sediment have been attributed to agricultural, urban, and ex-urban land development and management practices. This project will identify and prioritize various categories of alterations to the land and watershed hydrology that contribute most to excessive erosion and sedimentation. It will also identify additional factors contributing to beneficial use impairment, so that the appropriate mix of restoration measures and land use/development practices can be put in place where they achieve the greatest anticipated environmental benefits.

C. Problem Statement:

i. Identify or characterize baseline data

Several studies have recently been completed and published that document impairment to aquatic life uses in the Mill Creek Watershed. Excessive sediment is listed as one of the main causes of anadromous fisheries declines and extirpation of Coho salmon throughout the watershed. Sediment is also suspected as a factor that contributed to placing the California freshwater shrimp on the Endangered Species list. Oakwood County is currently preparing a Programmatic Environmental Impact Report and has completed a baseline data report, inventorying biological and cultural resources, geology, hydrology, and current land use. A digitized map of vegetation cover at a 1-m resolution exists for the whole county, including the Mill Creek Watershed. Extensive historical information has been assembled documenting pre-European land cover, land use changes in the past 150 years, and modification to the stream hydrology throughout the watershed.

ii. Identify pollution source categories

Agricultural land management practices, and to a lesser extent urban and ex-urban land uses are suspected to be the main sources of excessive sediment.

iii. Identify and describe current restoration activities; Best Management Practices (BMPs); load reduction activities; prevention activities

Oakwood County has had a hillslope protection ordinance in place for several decades that applies to slopes greater than 5%. The ordinance requires review, approval, and implementation of erosion control plans prior to conversions of natural land cover to agricultural uses. Until recently, erosion control measures included large-scale expansion of the drainage network through construction of hillslope drains removing water from fields in accelerated

fashion, reducing soil infiltration and causing major alterations in the hydrologic regime of tributaries and the mainstem of Mill Creek.

- iv. Describe the manner in which BMPs or Management Measures are proposed to be implemented

N/A

- v. Summarize how the effectiveness of proposed practices or measures in preventing or reducing pollution will be determined

N/A

- vi. Determine “changes in flow pattern” in affected water bodies

N/A. While this project will not be able to measure changes in flow pattern until Management Measures are implemented, it is designed to recommend opportunities for restoring flow where current water and land management practices have reduced dry-season base flow below critical threshold levels.

- vii. Determine economic benefits of implementing project

N/A. Not a requirement of AWQGP.

D. Project Activities or Tasks

Task 1: Project Management and Administration

Task 2: Develop detailed monitoring and assessment plan, including refinement of existing conceptual models reflecting our current understanding of watershed processes, and stating hypotheses that can be tested via spatial analysis.

Task 3: Develop Quality Assurance Project Plan linking project objectives with data quality objectives.

Task 4: Compile relevant historical and current datalayers and digitize maps (e.g., Mill Creek drainage network, land cover, documented wetland types and other habitats, floodplain structure); analyze and document change in georeferenced format; identify restoration constraints and opportunities.

Task 5: Obtain access permission to candidate field verification sites to spot-check interpretation of aerial photography and LIDAR images.

Task 6: Compile existing range of land management practices and document sites or areas of sediment sources, transport, and storage to land and water management practices.

Task 7: Compile a menu of alternative management practices and restoration measures tailored to sediment mobilization and storage problems identified in Task 4 and identify suitable monitoring sites where progress toward TMDL targets could best be tracked.

Task 8: Prepare final report and submit data to SWAMP database.

E. Category of Project Activities or Tasks:

All project activities and tasks fall into the Planning, Research, Monitoring and Assessment Category.

II. Project Goals & Desired Outcomes

The goals of this project are:

- 1) Assess where and what kind of land and water use practices have contributed most to impairment of aquatic live uses.
- 2) Provide the information necessary to implement a range of restoration measures and land/water management practices that could mimic historic watershed processes (e.g., restoration of storm hydrographs through detention and infiltration basins and rehabilitation of wetlands; establishment of riparian buffer zones and setback levees

The desired outcomes of this project are:

- 1) Identification and mapping of anthropogenic sediment “hot spots” and linkage to current land and water management practices, such as increases in the drainage density, impervious surfaces, and other hydromodifications, as well as ill-timed water diversions, and reduction of flood plain functions.
- 2) Development of site-specific and watershed-wide restoration and land management options capable of mimicking historic watershed functions and processes and capable of meeting TMDL implementation targets.
- 3) Identification of appropriate index sites for tracking TMDL implementation progress.

III. Project Performance Measures Tables

Table 1: Example Performance Indicators for Planning, Research, Monitoring, and Assessment Activities in Mill Creek Restoration Planning Project

Project Goals	Baseline Measurements and Information	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
1. Assess where and what kind of land and water use practices have contributed most to impairment of aquatic live uses.	1. Historical documentation of landcover and drainage network 2. LIDAR imagery; vegetation maps; 3. Current land cover and uses 4. Historical and current flow data	1. Digitized maps of historical and present channel network and hydrology 2. Digitized maps of historical and current habitat types	1. Site-, reach-, or area-specific options for alternative land/water management practices and restoration measures. 2. Conceptual restoration plans 3. Refinements to conceptual model of watershed processes and functions	<i>Documenting Local Landscape Change: the Bay Area Historical Ecology Project.</i> In: Egan, D. and E. Howell, editors, <i>The Historical Ecology Handbook: a Restorationist's Guide to Reference Ecosystems</i> (Island Press, Washington D.C.)	1. Broad acceptance of identified hot spots based on peer review. 2. Broad acceptance of conceptual model sediment reduction management options with identified hot spots based on peer review
2. Identify range of restoration measures and management practices that could mimic historic watershed processes and contribute to the prioritization of site-specific TMDL implementation options	1. Erosion control plans and list of BMPs currently in place or considered for implementation 2. TMDL implementation targets	1. Digitized map and classification of BMPs and restoration measures. 2. Digitized maps of known and potential salmonid spawning sites	1. Site-, reach-, or area-specific options for alternative land/water management practices and restoration measures. 2. Conceptual restoration plans 3. Refinements to conceptual model of watershed processes and functions. 3. TMDL monitoring plan elements related to tracking progress toward targets.	1. http://www.ctic.purdue.edu/Core4/CT/Choices/Choices.html 2. http://www.dfg.ca.gov/nafwb/manual.html 3. http://www.waterboards.ca.gov/sanfranciscobay/Agenda/04-16-03/Stream%20Protection%20Circular.pdf	1. Adopted list of restoration and land /water mgt. options 2. Adopted list of index sites for TMDL monitoring by WICC TAC

Prototype Project Assessment and Evaluation Plan
Education, Outreach, and Capacity-building

Evaluating Alternative Futures in the Mill Creek Watershed

I. Project Summary

A. Funding Program

The Project is supported by Proposition 40 as part of the Nonpoint Source Pollution Control Program and local and federal matching funds.

B. Project Description

Oakwood County and the Resource Conservation District are collaborating with USEPA, Office of Research and Development, on developing tools to evaluate "Alternative Futures" (see http://www.epa.gov/ord/scienceforum/PDFs/science/white_d.pdf). The "Alternative Futures" project involves building community capacity in the Mill Creek Watershed, particularly to raise community awareness about environmental issues, with emphasis on nonpoint source pollution in a watershed context, and to involve the watershed community in the planned update of the County's General Plan with the goal of including appropriate planning elements that enhance in-fill development and reduction of impervious surfaces and drainage density throughout the watershed.

C. Problem Statement:

i. Identify or characterize baseline data

The Mill Creek Watershed is experiencing rapid conversion from agricultural and forestry lands to urban and ex-urban development. The opening of a bullet train station in the southern part of the watershed five years ago enabled people that formerly lived closer to employment centers with high housing costs to move into more affordable housing on the urban fringe. The influx of new watershed residents translates into a Mill Creek Watershed population growth rate of 11% a year over the last five years. The project provides an opportunity to educate long-term residents as well as newcomers about non-point source pollution issues, the connection between land development decisions and beneficial use protection, and to involve them in a planned visioning process as part of Oakwood County's General Plan update. Baseline data exist in the County's Geographical Information System (GIS) and include digitized data layers of land use change from 1950-2005, urban growth projections, hydrology, wetlands and other sensitive and unique aquatic habitat types, vegetation at a resolution of 1m, and stormdrain infrastructure. The County also recently compiled a biological resource inventory.

ii. Identify one or more sources of pollution

Mill Creek is on the Impaired Waters list for sediment, nutrients, and pathogens. Agricultural management practices are implicated as the cause of erosion and sedimentation ; malfunctioning septic tanks are suspected as a source of pathogen contamination; and a combination of agriculture and urban land uses are suspected as the sources of nutrients.

- iii. Identify and describe current restoration activities; Best Management Practices (BMPs); load reduction activities; prevention activities

The County has an existing hillslope protection ordinance in place designed to minimize erosion from slopes greater than 5%. Agricultural landowners have implemented practices that drain runoff into extensive hillslope drainage networks discharging into tributaries of Mill Creek. Portions of the creek have experienced downcutting and bank erosion, and efforts are underway to restore floodplain functions in a four-mile reach in the central part of the watershed. TMDL implementation plans have not yet been developed or implemented for any of the three pollutant categories of concern.

- iv. Describe the manner in which BMPs or Management Measure are proposed to be implemented

N/A

- v. Summarize how the effectiveness of the proposed practices or measures in preventing or reducing pollution will be determined

N/A

- vi. Determine, to the extent feasible, changes in flow pattern in affected water bodies

N/A

- vii. Determine economic benefits of implementing project

N/A. Not a requirement of Proposition 40.

D. Project Activities or Tasks

Task 1: *Project Management and Administration*

Task 2: *Develop detailed survey and assessment plan, including a training manual. The plan will be comprised of proposed questions and methods for analysis of pre- and post-implementation survey results.*

Task 3: *Develop Quality Assurance Project Plan linking project objectives with data quality objectives.*

Task 4: *Administer pre-project survey representative of Mill Creek Watershed population with a target maximum error rate of +/-5%. The opinion poll will be designed to gauge the knowledge of residents about what "a watershed" is, pollution issues (source categories, activities contributing to pollution, understanding of impairment of beneficial uses, and understanding of the connection between land use and impairment).*

Task 5: *Work with Oakwood Community College Board of Trustees to incorporate new classes into Environmental Science Department and assist in development of an endowment for instructor position.*

Task 6: *Develop curriculum for Public Works, Planning, and Building Departments for County and Cities within the Mill Creek watershed related to nonpoint source pollution issues and the role of land use decisions in reducing aquatic life and recreation beneficial use impairment.*

Task 7: *Hold a series of five workshops and participate in key community events (Earth Day; Adopt a Watershed Day; Friday Fairs during the summer; Sustainable Farming fundraising event) to staff*

watershed awareness and education table, distribute fact sheets, and raise community awareness

Task 8: Work with Farm Bureau, Builders Association, and Chamber of Commerce to incorporate appropriately tailored staff and member training events, based on curriculum developed for agency staff and modified for professional association audiences.

Task 9: Conduct targeted outreach to environmental reporters of Oakwood Gazette and Hillview Register on Alternative Futures project and relevance to General Plan update. Work with County staff and community groups (e.g. Friends of Mill Creek, Property Rights and No Responsibilities Advocates of Oakwood, Get Government off My Back, SUE FFIRST!, etc.) to generate community awareness of Alternative Futures Project.

Task 10: Conduct post-implementation survey of pre-project respondents to gauge increase in watershed awareness.

E. Category of Project Activities or Tasks:

All project activities and tasks fall into the Education, Outreach, and Capacity-building Category.

II. Project Goals & Desired Outcomes

The goals of this project are:

- 1) Increase understanding of Mill Creek Watershed residents about basic watershed characteristics and processes and the role of nonpoint source pollution in beneficial use impairment*
- 2) Actively engage residents in the "Alternative Futures" visioning process which will inform the update of the County's General Plan.*

The desired outcomes of this project are:

- 4) Increase the number of watershed residents who can adequately describe what a "watershed" is by a minimum of 15% by the end of the project period.*
- 5) Oakwood College adds new, relevant curriculum components.*
- 6) Insure that a watershed stewardship curriculum is adopted by two professional organizations.*
- 7) Watershed science and planning curriculum is developed and adopted by the Public Works, Building, and Planning Departments throughout the County for in-house staff training purposes.*
- 8) Broad community attendance at the Alternative Futures kick-off meeting.*
- 9) Broad press coverage of the Alternative Futures Planning effort and outcomes.*

III. Project Performance Measures Tables

Table 2: Example PAEP Elements for Education and Outreach Activities for *Evaluating Alternative Futures in the Mill Creek Watershed*

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
1. Educate landowners and residents about baseline environmental conditions and watershed processes	1. Increase number of watershed residents who can adequately describe what a “watershed” is. 2. Oakwood College adds two new, relevant curriculum components. 3. Watershed stewardship curriculum is adopted by professional organizations.	1. No. of residents attending workshops; 2. No. of meetings held with College Board of Trustees for expanding course offerings; 3. No. of special events with relevant outreach material; 4. No. of meetings held with prof. associations	1. Increase in general watershed knowledge and environmental conditions; 2. No. of relevant new college courses offered. 3. No. of Farm Bureau, Builders’ Council, and other prof. associations’ relevant training classes	Opinion/Behavior Surveys (e.g., http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714-75944--,00.html)	1. 15% increase in watershed residents who can adequately describe what a “watershed” is. 2. Two new watershed curriculum components or courses at college. 3. A minimum of two professional orgs. have adopted and implemented watershed stewardship curriculum for in-house training
2. Provide understanding about land use decisions and NPS pollution	1. Watershed science and planning curriculum is developed and adopted by the Public Works, Building, and Planning Departments throughout the County for in-house staff training purposes.	1. No. of residents attending workshops; 2. No. of meetings held with College Board of Trustees for expanding course offerings; 3. No. of special events with relevant outreach material; 4. Course material developed for County Public Works and Planning staff	1. Increase in knowledge about NPS pollution and land use decisions; 2. Inclusion of NPS issues in land use planning and environmental science college curriculum 3. New training classes implemented for County Public Works and Planning staff	Opinion/Behavior Surveys	1. County staff training curriculum adopted and implemented. 2. 50% of County staff have command of relevant NPS/land use issues after first year of training. 2. Incorporation of NPS issues in new college watershed curriculum or courses
3. Involve residents in “Alternative Futures” project and General Plan update	1. Broad community attendance at the Alternative Futures kick-off meeting. 2. Broad press coverage of the Alternative Futures Planning effort and outcomes.	1. No. of residents participating in “Alternative Futures” workshops 2. No. of newspaper articles and other media coverage about Alternative Futures	1. Increase in County GIS analysis and IT capacity 2. Increase in candidates for political office with good NPS and watershed understanding	Specified by Grantee	1. 200 or more residents at “Alternative Futures” kick-off meeting. 2. Series of three newspaper articles on AF project. 3. Minimum of one candidate in city or county elections with good watershed understanding.

Prototype Project Assessment and Evaluation Plan
Habitat Restoration

Eradicating Arundo donax from the Mill Creek Watershed and Establishing a Re-introduction Prevention Program

I. Project Summary

A. Funding Program

The Project is supported by Proposition 40 as part of Integrated Regional Water Management and local and federal matching funds.

B. Project Description

Oakwood County and the Resource Conservation District are collaborating to build on recently completed mapping efforts in the Mill Creek Watershed and implement a full-scale Arundo donax (giant reed) eradication program based on the demonstration project methodology developed under a recently completed CALFED Ecosystem Restoration Program grant.

C. Problem Statement:

i. Identify or characterize baseline data

Infestation of the invasive giant reed (Arundo donax) has recently been mapped for the entire Mill Creek Watershed. Arundo is native to riparian areas in Asia and was promoted as an erosion control mechanisms in Soil Conservation Service handbooks until late into the last century. The giant reed alters riparian ecosystem functions and habitat values for native species in numerous ways, in addition to presenting a flood and fire management challenge. Although no systematic studies have been undertaken to document its impacts on evapotranspiration, it is also suspected to severely alter the water budget by accelerating transpiration of surface and subsurface water, thereby contributing to the dewatering of streams during periods critical to native fish species and aquatic invertebrates. Once established, giant reed outcompetes existing native riparian vegetation and generates monoculture stands. Mapping results indicate that about 420 acres are infested within the 200 square-mile watershed of Mill Creek. Arundo is known to only reproduce vegetatively, thereby enabling complete eradication in any given area, as long as removal is systematic from the top to the bottom of the watershed so that floods cannot disperse viable rhizomes or canes. The RCD conducted an extensive education and outreach campaign from 2003-05 targeted at affected landowners to facilitate access to infestation sites. An EIR was developed in early 2005, and all required permits are being processed at this time.

ii. Identify one or more sources of pollution

N/A

iii. Identify and describe current restoration activities; Best Management Practices (BMPs); load reduction activities; prevention activities

The County Department of Public Works has a removal policy in place, albeit only as part of its ongoing flood management and floodway maintenance program. The Resource Conservation District staff has obtained training in eradication methodology in a neighboring watershed but has heretofore lacked the funds to implement an eradication and re-infestation prevention program.

iv. Describe the manner in which BMPs or Management Measures are proposed to be implemented

We propose to utilize pond liner material after mechanically removing above-ground biomass to cover cut stands of Arundo and prevent the clones from photosynthesizing. This eradication methodology has proven to be the most cost-effective and least environmentally damaging alternative in the neighboring Russian River watershed. Usually, stands of Arundo are dead within two weeks. Above-ground biomass will be chipped as close to the eradication site as possible and composted on-site. Eradication will begin at the end of the wet season at the end of May in the uppermost reaches of Mill Creek and gradually work downstream toward the tidal marsh complex at the bottom of the watershed. Both the Public Works Department and the RCD will mobilize their existing volunteer crew and the California Conservation Corps to systematically remove canes and place pond liner over the remaining above- and below-ground biomass. We expect to be able to remove all 420 acres within the three-year project period.

v. Summarize how the effectiveness of project implementation will be measured

We propose to measure effectiveness of the project primarily through comparison of digital maps before eradication with site visits and ground photography at the end of the eradication period throughout the project as identified stands are eliminated. Updates to the digital datalayer housed at the RCD will be made after confirmation of non-viability of treated stands. Table 1 shows the proposed indicators to be used in evaluating effectiveness of the project.

vi. Determine, to the extent feasible, changes in flow pattern in affected water bodies

N/A

vii. Determine economic benefits of implementing project

N/A. Not a requirement of IRWMP.

D. Project Activities or Tasks

Task 1: *Project Management and Administration*

Task 2: *Develop detailed implementation and monitoring plans, outlining treatment locations, anticipated eradication sequence, and post-implementation documentation. Adjust safety procedures and field reconnaissance manual as necessary.*

Task 3: *Contact landowners and obtain permission to implement eradication*

Task 4: *Transport available pond liners from Healdsburg storage location in the Russian River watershed and distribute to Mill Creek staging areas according to implementation plan. Mobilize volunteer and staff.*

Task 5: *Train and mobilize field crews in safety procedures, for cane-cutting, micro-chipping, on-site composting of biomass, and placement of pond liners.*

Task 6: Conduct post-eradication site visits to document success.

Task 7: Prepare re-infestation prevention plan and incorporate plan into Public Works floodway maintenance SOPs.

Task 8: Prepare project completion report, including updated maps and updates to methods manual. Submit maps to GeoWBS.

E. Category of Project Activities or Tasks:

All project activities and tasks fall into the Habitat Restoration Category.

II. Project Goals & Desired Outcomes

The goals of this project are:

- 1) Eliminate Arundo donax from the Mill Creek Watershed*
- 2.) Adopt a re-infestation prevention plan*

The desired outcomes of this project are:

- 1.) Reduction of giant reed coverage of 420 acres to less than one acre.*
- 2.) Adoption of prevention plan and incorporation of re-infestation prevention plan into Public Works Department Standard Operating Procedures Manuals.*

III. Project Performance Measures Table

Table 3: Example PAEP Elements for Habitat Restoration Activities in Mill Creek *Arundo donax* Eradication Project

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
1. Eliminate <i>Arundo donax</i> from the Mill Creek Watershed	Reduction of giant reed coverage of 420 acres to less than 1	1. No. of landowners granting access permission; 2. No. of volunteers participating in training and implementation	1. Percent of each watershed segment with eradicated stands of <i>Arundo</i> . 2. Re-establishment of native riparian vegetation	Russian River <i>Arundo</i> Eradication Manual	100% eradication in upper and middle reaches of watershed; 90% eradication from lower watershed
2. Prepare a re-infestation prevention plan	Adoption of prevention plan and incorporation of re-infestation prevention plan into Public Works Department Standard Operating Procedures Manuals	1. Finalization of prevention plan 2. Integration with existing floodway maintenance SOPs	1. Adoption of prevention plan. 2. Broad knowledge of Public Works supervisors about SOP updates. 3. Floodway maintenance schedule based on watershed reaches sequenced from upstream to downstream	Specified by Grantee	100% county staff awareness of newly adopted SOP.

Prototype Project Assessment and Evaluation Plan
Pollutant Load Reduction

***Reducing Pesticide-induced Sediment Toxicity from Stonefruit Orchards in the
Mill Creek Watershed***

I. Project Summary

A. Funding Program

The Project is supported by Proposition 50 as part of the Agricultural Water Quality Grant Program and local and federal matching funds.

B. Project Description

The middle and lower reaches of Mill Creek and two of its tributaries have been placed on the “impaired waters list” for pesticide toxicity attributable to agricultural land use practices. This project is designed to demonstrate the efficacy of reducing pesticide use by 20% throughout the watershed and restore aquatic life beneficial uses in Mill Creek. It builds on several preceding efforts that assessed beneficial use impairment, developed a detailed conceptual model describing water and sediment transport processes throughout the watershed, as well as pesticide transport and fate. Targets for TMDL implementation have been adopted by USEPA, and implementation plans are currently under development. The project will contribute to fine-tuning several proposed implementation steps and provide “proof-of-concept” documentation for large-scale application of selected Best Management Practices.

C. Problem Statement:

i. Identify or characterize baseline data

*More than 40% of the watershed below river mile 42 is comprised of land cover consisting of stonefruit orchards and associated farm infrastructure (roads, both paved and unpaved, storage buildings, irrigation canals, etc.). The most recent pesticide use statistics show annual application rates of roughly 20,000 lbs of various synthetic pyrethroid compounds, comprising 95% of all pesticides applied. During synoptic sampling of Mill Creek and its two major tributaries draining agricultural land uses, nine out of ten samples exhibited sediment toxicity to bioassay organisms (*Hyalella* spp.).*

ii. Identify one or more sources of pollution

Stonefruit orchards are suspected to be the main source of pollution.

iii. Identify and describe current (if applicable) and proposed restoration activities; Best Management Practices (BMPs); load reduction activities; prevention activities

Several landowners with a combined acreage of 1,100 acres are transitioning to organic farming practices and are in their third year of conversion. The UC Cooperative Extension Program has begun to promote its Integrated Pesticide Management training curriculum, and the recent waiver conditions for Waste Discharge Requirements caused 99% of landowners to enroll in continuing education classes

pertaining to IPM, and management practices for pesticide impact reduction to receiving waters.

iv. Describe the manner in which BMPs or Management Measures are proposed to be implemented

This project will be testing the efficacy of three types of Management Measures in reducing sediment toxicity: 1) Enrolling 1,000 additional contiguous stonefruit acres in the “Going Organic” program. 2) Establishing detention ponds collecting orchard runoff at each discharge point into Mill Creek and tributaries that prevent contaminated sediment from being transported into receiving waters. 3) Implementing a combination of Integrated Pest Management practices by 90% of the stonefruit farmers in the Dry Creek watershed (one of the tributaries to Mill Creek), cover crop and buffer strip BMPs according to recent UC Cooperative Extension handbooks. Detention pond engineering designs have already been approved by all necessary local, state, and federal agencies, and 90% of Dry Creek watershed farmers have already signed up for the demonstration program.

v. Summarize how the effectiveness of project implementation will be measured

We will measure effectiveness of the project by taking an initial sediment sample set (n=30) distributed randomly in the middle and lower reaches of Mill Creek and its two tributaries to assess pre-implementation sediment toxicity. These random samples will be augmented by targeted water samples at the confluence of the ditches draining the largest contiguous parcels enrolled in the “Going Organic” program and the confluence of Dry Creek and ten farm drain outlets. The water samples will receive a pesticide scan and will be analyzed for pyrethroid pesticides. In addition, samples will be taken concurrently with sediment samples according to the recently developed bioassessment methodology for low-gradient streams and analyzed for aquatic macroinvertebrates. The same sampling regime will be followed in Year 3 after implementation of pesticide reduction measures.

vi. Determine, to the extent feasible, changes in flow pattern in affected water bodies

N/A

vii. Determine economic benefits of implementing project

N/A. Not a requirement of AWQGP.

D. Project Activities or Tasks

Task 1: Project Management and Administration

Task 2: Develop detailed monitoring plan, stating hypotheses to be tested, desired statistical power to be achieved, number of sampling sites required, and appropriate sample timing.

Task 3: Develop Quality Assurance Project Plan linking project objectives with data quality objectives.

Task 4: Work with UC Cooperative Extension staff to agendize feedback on monitoring plan by landowners and enhance participation in Dry Creek BMP pilot if necessary.

Task 5: Obtain access permission to candidate sampling sites (including replacement sites where permission is denied).

Task 6: Conduct landowner outreach and use existing education material to enroll additional farmers in “Going Organic” program.

Task 6: Implement pre-implementation sampling.

Task 7: Work with landowners and UC Cooperative Extension staff to track implementation progress.

Task 8: Conduct post-implementation sampling at the end of Year 2 and beginning of Year 3.

Task 9: Assess data and write evaluation report.

Task 10: Submit data to SWAMP database.

E. Category of Project Activities or Tasks:

All project activities and tasks fall into the Load Reduction Category.

II. Project Goals & Desired Outcomes

The goals of this project are:

- 1) *Demonstrate the environmental response to pesticide use reductions of 20%.*
- 2) *Contribute to achievement of TMDL target of zero sediment toxicity.*

The desired outcomes of this project are:

- 1) *Enrollment of an additional 1,000 contiguous acres in the “Going Organic” Program*
- 2) *Enrollment of 90% of Dry Creek farms in BMP testing program.*
- 3) *Reduction in pesticide use by 20%*
- 4) *Reduction of toxic “hits” between pre-project conditions and project implementation by 75%*
- 5) *Increase in benthic macroinvertebrate diversity*

III. Project Performance Measures Table

Table 4: Example PAEP Elements for Pollutant Load Reduction Activities in *Reducing Pesticide-induced Sediment Toxicity from Stonefruit Orchards in the Mill Creek Watershed*

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
1. Demonstrate the environmental response to pesticide use reductions of 20%.	1. Increase in contiguous acreage in the “Going Organic” Program. 2. Large-scale enrollment of Dry Creek farms in BMP testing program. 3. Pesticide use reduction 4. Reduction of sediment toxicity 5. Increase in benthic macroinvertebrate diversity	1. No. of landowners granting access permission; 2. No. of contiguous acres enrolled in “Going Organic” 3. Number of Dry Creek landowners participating in monitoring plan workshop 4. Number of Dry Creek landowners following implementation schedule	1. Percent reduction of sediment toxicity hits 2. Percent increase in aquatic macroinvertebrate diversity 3. Percent reduction in pesticide use 4. Percent reduction in pyrethroid concentrations in orchard drain water	1. Sed. tox. Bioassay standard procedures; 2. Hayworth, J.D. and G. Siemering. July 2003. Aquatic Pesticide Monitoring Program Phase 2 Monitoring Plan. San Francisco Estuary Institute, Oakland, CA. 3. DFG, Rancho Cordova, GC-ECD or GCMS methods.	1. Enrollment of an additional 1,000 contiguous acres in the “Going Organic” Program. 2. Enrollment of 90% of Dry Creek farms in BMP testing program. 3. Statistically significant increase in benthic macroinvertebrate diversity. 4. Pesticide use reduction of 20%.
2. Contribute to achievement of TMDL target of zero sediment toxicity	Reduction of sediment toxicity	1. No. of landowners granting access permission; 2. No. of contiguous acres enrolled in “Going Organic” 3. Number of Dry Creek landowners participating in monitoring plan workshop. 4. Number of Dry Creek landowners following implementation schedule	1. Percent reduction of sediment toxicity hits 2. Percent increase in aquatic macroinvertebrate diversity 3. Percent reduction in pyrethroid concentrations in orchard drain water	Same as above	Reduction of toxic “hits” between pre-project conditions and project implementation by 75%.

Project Assessment and Evaluation Plan (PAEP) Outline
Water Conservation, Reliability Enhancement, and Recycling

Northern Mill Creek Watershed Irrigation Improvement Project (Project)

I. Project Summary

A. Funding Program

This Project is funded by an Agricultural Drainage Management Loan Program (ADMLP) created by the Water Conservation and Water Quality Bond Law of 1986.

B. Project Description

This Project will purchase high efficiency irrigation equipment, and backflush recycling systems, to prevent untreated irrigation wastewater, from polluting waters of the state. The equipment purchased will be leased and operated by the Northern Mill Creek Watershed Irrigation District (the District) to reduce drainage impacts and improve water use efficiency. This Project will conserve water; reduce the discharge of salt, boron, nitrogen, and sediment to Mill Creek; and provide greater drinking water supply reliability.

C. Problem Statement

The northern part of the Mill Creek Watershed has been a farming community since the 1800's, when early immigrants first settled it. Over the years, the smaller diversified farms turned to larger monoculture businesses with more intensified farming. Salmon have historically used the Northern Mill Creek Watershed as a main conduit for travel to reach their spawning headwater streams. However, increased demand for irrigation water due to larger and more intensive farming has resulted in reduced habitat and warmer stream temperatures for fish. As a result, the salmon population within Mill Creek has been declining.

Nitrogen loading from runoff, coupled with sediment runoff that contains phosphorus, has also contributed to algae blooms. And in some areas where the water table is low, nitrogen is able to infiltrate into ground water aquifers, which historically had been used as a main source for most of the community's drinking water.

i. Identify or characterize baseline data

Baseline data includes; District water use records for the past 5 Years; 10 years of Mill Creek flow and temperature data recorded by a USGS gauging station; and the Mill Creek Watershed Protection Group data from two sampling stations in the Northern Mill Creek Watershed for Nitrogen and Salinity, 3 hour average sampling for the past two summers.

Habitat surveys for juvenile salmonids have also been conducted the Past 3 summers by the Friends of Fish 4 Mill Creek (FoF4MC). Percent of Dominant Substrate, Pool Tail Embeddedness, Pool Tail Substrate, and Substrate Composition was recorded. Bank erosion was also recorded along a 4-mile stretch of stream within this watershed.

Records of average nitrogen samples taken over 10 years for a well under flood irrigated farmland. Within these 10 years, samples were taken by three previous landowners, with one taking as little as two samples, and one taking as many as 72 samples.

ii. Identify pollution source categories

The northern end of Mill Creek is surrounded by multiple highly intensive agricultural communities. These communities have expanded greatly as a result of a historical farming infrastructure, productive land, large-scale farming investments, and close proximity to distributors in nearby urban cities. As a result of the growth in the agricultural community and change in agricultural management practices, nitrogen, sediment, and salt-loading has increased. Nitrogen infiltration has also become a problem in aquifers over agricultural land with low water tables.

iii. Identify and describe current restoration activities; Best Management Practices (BMP's); Load reduction activities; Prevention activities

A bank stabilization project was done on a .25 mile stretch of Mill Creek by the Friends of Fish 4 Mill Creek, to help deal with a sliding bank. Also, two of the farmers along Mill Creek are enrolled in the Conservation Reserve Program, and have developed a 250-foot buffer strip along each side of the stream. Although some small, separate projects have occurred, a larger more integrated approach needs to be taken.

iv. Describe the manner in which the proposed best management practices or management measures will be implemented

Loans will be made available to farmers in the District to replace their old irrigation systems with more effective high efficiency irrigation systems and backflush recycling systems. In doing so, farmers in the District will use less water, keep more nutrients on the ground and in the plants, and improve surface and ground water quality.

The program will be advertised in monthly news flyers, at regular public meetings, special informational meetings, through an informational email list, by word of mouth during interaction with local farmers, and on the local radio station.

v. Summarize how the effectiveness of proposed practices or measures in preventing or reducing pollution will be determined

Amount of total water use by the District will be calculated and compared between years. Pollution reduction will be estimated by using the results from a study at Mill Creek University.

The study will be looking at “average” concentrations of nitrogen, sediment, and salt for the various irrigation systems on the market for 4 different crops on local soil environments. Data from the study will be used to estimate the water quality improvement as a result of replacing equipment. Pollutant load reduction will be calculated based on quantity of water applied, type of equipment installed, and crop type. Calculations will be modified to account for change in soil type, as needed. The water quality pollutants will also be measured downstream of project areas over the next 10 years to help determine project success.

For at least one site, monitoring of well water will be conducted, using a University lab. Samples have been collected at this location over the past 10 years, as a result of the interest from past owners who had either lived on the land or wanted to pump the water to a nearby track of land for residential use. Another set of samples will be taken 6 months before installation of the equipment and every year following the installation until the end of the Useful Project Life.

vi. Determine “Changes in flow pattern” in affected water bodies

The District plans to conserve 1,580 acre-feet of water in the next two years by replacing its inefficient irrigation systems with more efficient irrigation systems. If this project is shown to be successful, more projects like this may be implemented in the future, allowing for more water savings. The District also plans to completely stop the infiltration of nitrogen to a groundwater aquifer on agricultural land that has a low groundwater table.

vii. Determine economic benefits of implementing project

Although there is a price tag of approximately \$1,241/acre for replacement of the old equipment, the price of not replacing such equipment, is likely to create other costs now and in the future. Such costs include, reduced water supply reliability, reduced sport & commercial fishing, reduction in genetic pool & biodiversity on neighboring preservation land, and reduced property values. If these practices are implemented throughout the District, the benefit for replacement will out weigh the costs, through improved quality of life for individuals and the community.

D. The Following Project Activities or Tasks will be Completed to Address the Issues or Problems:

Task 1. Administrative Responsibilities.

Provide all technical and administrative services needed for Project Completion; monitor, supervise, and review all work performed; and coordinate budgeting and scheduling to assure that the Project is completed within budget, on schedule, and in accordance with approved procedures, applicable laws, and regulations. This includes, but is not limited to:

- (A) Establishing the acquisition, administrative and leasing criteria necessary to implement the Project.*
- (B) Establishing criteria for estimating the improvements in efficiency that will result from irrigation improvements through equipment acquisitions, and for determining whether or not applicants for irrigation improvement leases are credit-worthy.*
- (C) Ensuring that the growers understand that they may be subject to periodic inspections.*
- (D) Establishing separate and complete records and files on leases made to growers for irrigation equipment acquired under the terms of this agreement.*
- (E) Accounting procedures shall be in accordance with generally accepted accounting principles and practices, consistently applied, and shall provide sufficient and effective accountability and control of all Project funds.*

Task 2. Outreach

Conduct continuous outreach to farmers and equipment dealers to encourage participation in the program.

Task 3. Acquire “the Equipment”.

Adopt a formal bid process on each project. Purchase high efficiency irrigation equipment, and backflush recycling systems by awarding subcontract(s) to appropriate organization(s) to perform tasks as outlined in the Agreement, Document steps taken in soliciting and awarding the subcontract, and submit them to the State Water Board’s Project Representative for review.

Task 4. Supervise Construction/Installation

Ensure that equipment acquired under the terms of this agreement is constructed and installed correctly and expeditiously.

Task 5. Lease “the equipment”

Lease the equipment and systems (collectively, “the equipment”) to contracted growers.

Task 6. Calculate Post Implementation Results

Compare the expected or the actual result in efficiency of new systems to baseline data and calculate water conservation and reduction in pollutant load (sediment, salt etc.).

Task 7. Reporting

Expedientiously provide, during implementation and upon completion of the Project and thereafter during the Useful Life of the Project, such reports, data, and information as may be reasonably required by the State Water Board's Project Representative, including but not limited to material necessary or appropriate for evaluation of the State Water Board's program or to fulfill any reporting requirements of the state government. Examples of these include:

- (A) Progress Reports. Submit quarterly progress reports during Project Implementation. The description of activities and accomplishments of each task during the quarter shall contain sufficient detail to provide a basis for payment of invoices and shall be translated into percent of task work completed for the purpose of calculating invoice amounts.*
- (B) Project Assessment and Evaluation Plan. Shall provide data consistent with the format, schedule and other guidelines specified and shall be approved by the State Water Board's Project Representative.*
- (C) Final Project Summary Report. Submit to the State Water Board's Project Representative a copy of a Final Project Summary Report within 60 days following Project Completion.*

E. Category of Project Activities or Tasks:

Tasks	Category
1. Administrative Responsibilities	Planning, Research, and Assessment
2. Outreach	Education, Outreach, and Capacity-building
3. Acquire "the Equipment"	Water Conservation, Reliability Enhancement, and Recycling
4. Supervise Construction/Installation	Water Conservation, Reliability Enhancement, and Recycling
5. Lease "the Equipment"	Water Conservation, Reliability Enhancement, and Recycling
6. Calculate Post Implementation Results	Planning, Research, and Assessment
7. Reporting	Planning, Research, and Assessment

II. Project Goals & Desired Outcomes

(Unless otherwise stated, the following goals will be accomplished by the Mill Creek Water District and will occur by project completion.)

The goals of this project are:

- 1. Conserve water used for irrigation purposes within the District by installing high efficiency irrigation equipment, allowing more water to remain in the stream for aquatic life.*
- 2. Recycle water in the District to allow for more water to remain the stream for aquatic life.*
- 3. Reduce tailwater in the District to protect against public health hazards.*
- 4. Improve the reliability of low groundwater aquifers (that reside under agricultural land) as a source for drinking water purposes.*

The desired outcomes of this project are:

1. *1,580 acre feet of water that is diverted from irrigation use to remain in Northern Mill Creek for aquatic life.*
2. *15,800 acre feet of water that is diverted from irrigation use to remain in Northern Mill Creek for aquatic life by the year 2020.*
3. *2° C Colder water in refugia pools to reduce the stress of migrating salmonids by the year 2025.*
4. *250 acre-feet of water treated and recycled back onto farmland to remain in Northern Mill Creek for aquatic life.*
5. *90% of farms in the District without tailwater to prevent against public health hazards.*
6. *Elimination of all Tailwater from the District to protect against public health hazards by 2020.*
7. *A policy set in place restricting tailwater.*
8. *Provide for improvement in at least one well, through this project to act as an example for others with low water tables over agricultural land in the District.*
9. *Three aquifers in the district that meet the drinking water standard within the next 50 years.*

III. Project Performance Measures Table

Table 5
Water Conservation, Supply Reliability Enhancement & Recycling
Northern Mill Creek Agricultural Drainage Management Loan (ADMLP) Program

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools & Methods	Targets
1. Conserve water used for irrigation purposes within the District by installing high efficiency irrigation equipment, allowing more water to remain in the stream for aquatic life	1. More water in the creek for aquatic life. 2. Colder water in refugia pools to reduce the stress of migrating salmonids.	1. Pages of Water Use Records 2. Number of high efficiency irrigation units installed. 3. Pages of Temperature Data.	1. Number of Acre-feet of water conserved. 2. Number of Acre-feet of water conserved 3. Degree in temperature decrease.	1. <u>Tools</u> - District Water Use Records <u>Methods</u> - Calculate an average year of water use from the stream before equipment installation and after equipment installation. 2. <u>Tools</u> - District Water Use Records <u>Methods</u> - Calculate an average year of water use from the stream before equipment installation and after equipment installation. 3. <u>Tools</u> - Hobo Temperature Autosampler recorded during salmonid migration season by <i>FoF4MC</i> . <u>Methods</u> -Compare average yearly temperature before and after installation of equipment.	1. Conserve 1,580 acre feet of water by project completion. 2. Conserve 15,800 acre feet of water by the year 2020. 3. Decrease in average refugia holding pools temperature by 2° C for by the year 2025.
2. Recycle water in the District to allow for more water to remain the stream for aquatic life.	1. More water in the Creek for aquatic life 2. Colder water in refugia pools to reduce the stress of migrating salmonids.	1. Pages of Water Use Records 2. Number of tailwater recirculation units installed. 3. Pages of Temperature Data.	1. Number of Acre-feet of water recycled 2. Degrees in temperature decrease	1. <u>Tools</u> -Water Use Records from the District <u>Methods</u> -Calculate an average year of re-use of water before & after equipment installation 2. <u>Tools</u> -HoboTemperature Autosampler, <u>Methods</u> : <i>FoF4MC</i> record hourly temperature data in holding pools during salmonid migration seasons and compare over time	1. 250 Acre-Feet of water recycled by the end of the Useful Life of the Project. 2. Decrease in average refugia holding pools temperature by 2° C by the year 2025.

Table 5 (continued)
Water Conservation, Supply Reliability Enhancement & Recycling
Northern Mill Creek Agricultural Drainage Management Loan (ADMLP) Program

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
3. Reduce tailwater in the District to protect against public health hazards	1. A reduction in tailwater in the District . 2. Elimination of all Tailwater from the District by 2020 to protect against public health hazards. 3. A district policy set in place restricting tailwater by 2020.	1. Number of high efficiency irrigation units installed. 2. Number of sprinkler and gated pipe systems removed. 3. Draft tailwater policies	1. Percent of the District property owners without tailwater. 2. Percent of the District property owners without tailwater 3. Presence of a tailwater policy in the Districts policy that restricts tailwater.	1. <u>Tools</u> - District GIS Maps, aerial photos ,and direct survey. <u>Methods</u> - Use recent property GIS layer and present/future aerial photos to determine past tailwater locations and locations after the Useful Life of the Project. Verify on the ground. 2. <u>Tools</u> - District GIS Maps, aerial photos, and direct survey. <u>Methods</u> - Use recent property GIS layer and future aerial photos to determine 2020 locations. Verify on the ground. 3. <u>Tools</u> - A record of the District Policies <u>Methods</u> Verify that a tailwater policy is in place by checking district records up to 2020	1. 90% of District property owners without tailwater by the end of the Useful Life of the Project. 2. 100% of the District property owners without tailwater by 2020. 3. A policy set in place restricting tailwater by 2020.
4. Improve the reliability of low groundwater aquifers (that reside under agricultural land) as a source for drinking water purposes	1. Provide for improvement in at least one well, through this project to act as an example for others with low water tables under agricultural land in the district. 2. Three aquifers in the district, that meet the drinking water standard that had not previously met the drinking water standard.	1. Number of projects installed over low aquifer agricultural land. 2. Number of total nitrogen samples taken. 3. Number of projects installed over low aquifer agricultural land. 4. Number of total nitrogen samples taken.	1. Number of wells that have a lower average of nitrogen levels in the water that meet drinking standards then those that did before project implementation. 2. Number of aquifers that meet the drinking standard for nitrogen, but didn't meet it 50 years ago before "high efficiency irrigation projects" were installed	1. <u>Tools</u> Nitrate samples/records of samples from the well before and after the project. <u>Methods</u> - Compare historical samples as well as University sample taken 6 months before the project to samples taken at the end of the project. Follow project monitoring plan, QAPP, and SWAMP protocols. 2. <u>Tools</u> Nitrate samples/records of samples from the well before and after the project. <u>Methods</u> - Compare historical records/before samples to samples taken 50 years later. Follow SWAMP protocols.	1. One well over agricultural land that has lower average nitrogen levels in the water that meet drinking water standards (that had not met standards before equipment installation) by the end of the Useful Life of the Project. 2. Three aquifers that meet the drinking water standard for nitrogen (that had not previously met it before "high efficiently irrigation projects" were placed on the ground), within the next 50 years.

Project Assessment and Evaluation Plan (PAEP) Outline
Flood Attenuation and Floodplain Protection

Mill Creek Wetland Restoration

I. Project Summary

A. Funding Program: *This Project is funded by Proposition 50 Coastal Nonpoint Source Program (CNPS).*

B. Project Description: *The City of Millstone (the City) will purchase the remaining center acre of a 124 piece of land along the mainsteam of Mill Creek, which drains to the Ocean. This tributary is the main channel that salmon and steelhead enter when returning to the Northern and Southern tributaries during fall runs. Through this project, the City will restore the entire 124 acre track to its original condition, to provide flood attenuation, floodplain protection, and restore salmonid habitat.*

C. Problem Statement: *At the base of the Mill Creek watershed, Millstone, a medium sized port town, was established in the 1800's. Shippers found it an easy access point from which to sell and buy goods. Many fishermen also called Millstone home, and made a living catching various fish around the port. Salmon have historically used the Mill Creek watershed as a main conduit for travel to reach their spawning headwaters above Northern and Southern Mill Creek.*

Since the 1800's, Millstone has grown from a medium sized port town to a large industrial city. As a result of this urbanization, the historic estuary that once was home to many birds and wildlife and offered flood protection, has diminished to half its historic size. The berms that protect this now booming metropolis are growing old. The fishing is not what it used to be, and the birds and wildlife numbers are dwindling, as a result of lack of habitat.

The City has recently come to the conclusion that with the decline in the fisheries industry, tourism, and threat of failing levees, this growth is not sustainable and is now working to acquire land in the floodplain. This project is part of the City's overall plan to provide flood protection, preserve open space, and restore fisheries habitat.

i. Identify or characterize baseline data

Baseline data includes county aerial photos taken every 5 years over the past 50 yrs., GIS digitized wetland areas from 1996, 1900's fish processing numbers, Department of Fish and Game last 20 years spawning surveys, and 10 years of water quality data from USGS stations upstream and downstream of the site.

ii. Identify pollution source categories

Wetland restoration will provide flood protection and habitat, as well as reduce other pollution sources upstream. This pollution includes, urban runoff from pesticides, fertilizers, and heavy metals from water recycling, along with nitrogen & sediment from the Northern Mill Creek Watershed.

iii. Identify and describe current restoration activities; Best Management Practices (BMP's); Load reduction activities; Prevention activities

The city has required all property within 2 miles of the designated estuary property, be rezoned as the property becomes available for sale. A conservation fund has been set up, from which various sources contribute. Among these sources are CEQA mitigation funds from past projects. This fund has been used to purchase back the sold land for fair market value once it became available. The same fund will be used to purchase the remaining piece of land.

iv. Describe the manner in which the proposed best management practices or management measures will be implemented

The 1 acre section of land will be purchased at appraised value. The project will then research the best design for the 124 acres to provide the most effective habitat, water quality, flood protection, and flood attenuation. The plans will be drawn up and the best plan will be chosen. Construction will then occur. The old building wreckage, concrete bases, old drainage pipes, and remaining warehouse will be removed. Berms will be placed on the border of the east side of the 124 acre property using material from the berms on the west side. Native seed from surrounding wetlands will be brought in to speed the restoration process.

v. Summarize how the effectiveness of proposed practices or measures in preventing or reducing pollution will be determined

Water quality is monitored from a USGS station upstream and downstream of the site. Data will be compared before and after the project. The restoration itself will be monitored over the next 10 years. Soils, hydrology, and plants will be surveyed to make sure the ecosystem comes back. Wetland health will be monitored and rated. Flood protection will be estimated by determining storage through post- construction surveys and measurement of stage levels. A model will be used to determine yearly flood storage and storm protection.

vi. Determine "Changes in flow pattern" in affected water bodies

The USGS Stations will monitor flow readings before and after wetland creation. Precipitation, high water tides, and water storage will all be determined through modeling before the wetland is created. The wetland will then be created. Surveying be performed to compare the estimated model with the actual numbers.

vii. Determine economic benefits of implementing project

Economic benefits include flood protection, flood attenuation, fisheries enhancement, and tourism investment. Millstone tourism business has

always been a prominent part of the city, with historic downtown shops, famous breweries, and candy production plant; 15% of the economy is generated by tourism dollars. However, with the new demand for ecotourism, new ecotour businesses are drawing even more people to the town with tours of the Millstone estuary, nature walks, canoe trips, kayaking, whale watching, and private charters for salmon fishing. Adding to the estuary will help this new tourism to continue to grow, and may reach upwards of 20% of the cities economy.

D. The Following Project Activities or Tasks will be Completed to Address the Issues or Problems:

Task 1. Project Management and Administration. *Provide all technical and administrative services as needed for Project Completion; monitor, supervise, and review all work performed; and coordinate budgeting and scheduling to ensure the Project is completed within budget, on schedule, and in accordance with approved procedures, applicable laws, and regulations.*

Task 2. Purchase the Land
Have the land appraised and purchase the land for fair market value.

Task 3. Complete all CEQA and Permitting
Obtain all required permits from the designated agencies.

Task 4. Design the Wetland
Using a modeling program, past construction maps, and surrounding environmental details, design a wetland area that will provide the most water quality, habitat, flood attenuation, and floodplain protection benefits, at a reasonable cost.

Task 5. Construction
Remove all old building wreckage, concrete bases and the remaining warehouse from the land. Regrade the land, using the design plans. Dredge fill material from on site, including the current berm, to build the new berm.

Task 6. Post Construction Surveying
Verify post-construction elevations match the design and pre-construction model.

Task 7. Reseed and Replant with Native vegetation
Use surrounding native plant material to accelerate the restoration process through reseeding and transplanting.

Task 8. Monitoring. (Survey the Wetland & Water Quality)
Survey the wetland each year during the dry and wet season. Monitor the wetland health by characterizing soils, hydrology, and plants. Monitor water storage and water quality.

Task 9. Calibrate the model with real time data

Compare the real wetland data with the modeling data. Calibrate the model to the wetland. Using real time data, predict future wetland health and estimate load reductions, habitat benefit, floodplain protection, and flood attenuation over the next 40 years.

Task 10. Reporting Expediently provide, during implementation or upon completion of the Project and thereafter during the Useful Life of the Project, such reports, data, and information as may be reasonably required by the State Water Board's Project Representative, including but not limited to material necessary or appropriate for evaluation of the State Water Board's program or to fulfill any reporting requirements of the state government. Examples of these include:

- (A) *Progress Reports* Submit quarterly progress reports during Project Implementation. The description of activities and accomplishments of each task during the quarter shall contain sufficient detail to provide a basis for payment of invoices and shall be translated into percent of task work completed for the purpose of calculating invoice amounts.
- (B) *Project Assessment and Evaluation Plan*. Shall provide data consistent with the format, schedule and other guidelines specified and shall be approved by the State Water Board's Project Representative.
- (C) *Final Project Summary Report*. Submit to the State Water Board's Project Representative a copy of a Final Project Summary Report within 60 days following Project Completion.

E. Category of Project Activities or Tasks:

Tasks	Category
1. Project Management & Administration	Planning, Research, and Assessment
2. Purchase the Land	Flood Attenuation and Floodplain Protection
3. Complete All CEQA & Permitting	Planning, Research, and Assessment
4. Design the Wetland	Planning, Research, and Assessment
5. Construction (Building Removal, Land Grading & Berm)	Flood Attenuation and Floodplain Protection
6. Post Construction Surveying	Planning, Research, and Assessment
7. Reseed & Replant with Native vegetation	Habitat Restoration
8. Monitoring (Survey the Wetland & Water Quality)	Planning, Research, and Assessment
9. Calibrate the Model with Real Time Data	Planning, Research, and Assessment
10. Reporting	Planning, Research, and Assessment

II. Project Goals & Desired Outcomes

(Goals are to occur by the end of the project and be performed by Millstone (the City) unless stated otherwise.)

The goals of this project:

- 1. Purchase the remaining acre of floodplain land from Pacific Packaging with Conservation Fund money within the first six months of the project to be used for floodplain protection.*
- 2. Construct a wetland that reflects the best representation of the design specifications to provide for flood plain protection and flood attenuation.*
- 3. Construct a 124 acre wetland that provides 186 acre feet of protection against flooding for flood attenuation.*
- 4. Provide 390 acre-feet of water storage in one continuous corridor of wetland habitat in the event of a flood for flood attenuation.*
- 5. Produce a wetland with stable native vegetation within 20 years of planting that provides a breaker which on average slows the velocity of water by 3% in winter storm surges for floodplain protection.*

The desired outcomes of this project are:

- 1. The last needed acre of the 124 acres of land under the ownership of the City by the first six months to be used for floodplain protection*
- 2. A wetland on the ground that reflects the best representation of the design specifications in order to provide the best flood plain protection and flood attenuation.*

3. *A wetland that provides 186 acre-feet of protection against flooding.*
4. *A flood catchment area that is large enough to hold 390 acre-ft of water storage in the event of a flood.*
5. *A wetland with stable native vegetation within the 20 years of planting that provides a breaker, which on average slows the velocity of water in winter storm surges by 3%.*

III. Project Performance Measures Tables

Table 5
Flood Attenuation and Floodplain Protection
Mill Creek Wetland Restoration

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
1. Purchase the remaining acre of floodplain land from Pacific Packaging with Conservation Fund money within the first six months to be used for flood protection.	1. The acre of land under the ownership of the City by the first six months to be used for floodplain protection.	1. Escrow Paper Work 2. Records of funds transferred from the Conservation Fund to Pacific Packaging. 3. Property appraisals.	1. The Deed to the land with the City's signature	1. Calendar & Deed- Has the deed been signed 6 months after contract approval? Yes-met goal, No-didn't	1. A Deed signed over to the City 6 months after contract signature.
2. Construct a wetland that reflects the best representation of the ideal design specifications to provide for the best flood plain protection and flood attenuation	1. A wetland that reflects the best representation of the design specifications (see planning table for goals of ideal design specifications) in order to provide the best flood plain protection and flood attenuation.	1. Check forms/notes from 3 horticulturalists. 1. List of horticulturalists that reviewed the wetlands. 2. Check forms/notes from 3 hydrologists. 2. List of hydrologists that reviewed the wetlands. 3. Check forms/notes from 3 soil scientists. 3. List of soil scientists that reviewed the wetlands.	1. Number of wetlands that incorporate the plants as specified in the PDS, as seen by 3 project horticulturalists. 2. Number of wetlands that incorporate the hydrology as specified in the HDS, as seen by 3 project hydrologists. 3. Number of wetlands that incorporate the soil as specified in the SDS, as seen by 3 project soil scientists.	1. <u>Tools:</u> Plant Design Specs. (PDS) <u>Method:</u> Use the PDS to compare to the finished project to see if the finished project represents the PDS. 2. <u>Tools:</u> Hydrology Design Specs. (HDS) <u>Method:</u> Use the HDS to compare to the finished project to see if the finished project represents the HDS. 3. <u>Tools:</u> Soil Design Specs. (SDS) <u>Method:</u> Use the SDS to compare to the finished project to see if the finished project represents the SDS.	1. A wetland that incorporates the plants as specified in the plants design specifications, as seen by 3 project horticulturalists. 2. A wetland that incorporates the hydrology as specified in the hydrology design specifications as seen by 3 project hydrologists. 3. A wetland that incorporates the soils as specified in the soil design specifications as seen by 3 project soil scientists.

Table 5 (Continued)
Flood Attenuation and Floodplain Protection
Mill Creek Wetland Restoration

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
3. Construct a 124 acre wetland that provides 186 acre-feet of protection against flooding for flood attenuation	1. A wetland that provides 186 acre-feet of protection against flooding.	1. Number of transects taken. 1. Average depths of water across each transect.	1. Number of acre-feet of protection against flooding for flood attenuation.	1. <u>Tools</u> :-Wetland 3-D (Model) <u>Method</u> : Transects will be taken after the grading. A 3-D model will be built using the dimensions of the wetland project and the flow data. The acre-feet storage will be determined	1. 124 acre wetland that provides 186 acre-feet of protection against flooding for flood attenuation
4. Provide 390 acre-feet of water storage area in one continuous corridor of wetland habitat in the event of a flood for flood attenuation.	1. A flood catchment area that is large enough to hold 390 acre-ft of water storage in the event of a flood.	1. Pages of past depth and flow records 2. Wetland area that links to the new wetland.	1. 390 Acre-Feet of water storage area in one continuous wetland habitat corridor.	1. <u>Tools</u> : GIS Aerial Photos Past Depth and Flow Records of Historic Wetlands, and New Estimates of the constructed wetland. <u>Method</u> : Map the wetland habitat in the City using GIS to determine what areas are continuous. Using past historic wetland records determine the storage within the historic wetlands that link to the new wetland and add the new numbers determined from the constructed wetland.	1. Provide 390 acre-feet of water storage area in one continuous corridor of wetland habitat in the event of a flood for flood attenuation.

Table 5 (Continued)
Flood Attenuation and Floodplain Protection
Mill Creek Wetland Restoration

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
5.) Produce a wetland with stable native vegetation within the 20 years of planting that provides a breaker which on average slows the velocity of water in winter storm surges for floodplain protection.	1. A wetland with stable native vegetation that provides a breaker, which on average slows the velocity of water in winter storm surges by 3%.	1. Pages of Data Collected 2. Number of Plots sampled.	1. Percent change in velocity of water over the 20 years.	1. <u>Tools:</u> Measuring stick, stakes, ropes, flow and wind instrumentation. <u>Methods:</u> Set up transects. Determine average plant growth each year. Measure average flow and average wind speed during winter storms. Compare the flow measurements over 20 years, while considering wind speed.	1. A wetland with stable native vegetation within the 20 years of planting that provides a breaker, which on average slows the velocity of water in winter storm surges by 3%.

WEBSITES FOR PERFORMANCE MEASUREMENT INFORMATION
(Many of the web resources are applicable to multiple activity categories)

PROJECT PLANNING, RESEARCH, MONITORING, AND ASSESSMENT (many of these resources also apply to BMP implementation or habitat restoration effectiveness monitoring)

<http://cwam.ucdavis.edu/>

http://www.waterboards.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml

http://www.waterboards.ca.gov/water_issues/programs/swamp/

<http://www.epa.gov/watertrain>

http://www.dfg.ca.gov/cabw/csbp_2003.pdf

<http://www.cramwetlands.org/>

<http://www.calfish.org/DesktopDefault.aspx?tabId=112>

http://www.cnr.berkeley.edu/forestry/comp_proj/DFG/Monitoring%20the%20Implementation%20and%20Effectiveness%20of%20Fisheries.pdf

<http://mpsl.mlml.calstate.edu/swcompare.htm>

EDUCATION AND OUTREACH

http://www.michigan.gov/deq/0,1607,%207-135-3313_3682_3714-75944--,00.html

<http://learningstore.uwex.edu/Program-Development-Evaluation-C234.aspx?UserID=14962656&SessionID=9aNAysQXXQLG7d2UrTcb>

HABITAT RESTORATION

<http://www.dfg.ca.gov/fish/Resources/HabitatManual.asp>

<http://www.epa.gov/watertrain/restor.html>

http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stream_and_wetland_protection.shtml

<http://water.usgs.gov/nawqa/protocols/OFR-93-408/habit1.html>

<http://www.epa.gov/watertrain/river/>

POLLUTANT LOAD REDUCTION

<http://it.tetrattech-ffx.com/stepl/>

BENEFICIAL USE IMPROVEMENT AND PROTECTION

<http://www.cdph.ca.gov/certlic/drinkingwater/Pages/TMF.aspx>

<http://www.dhs.ca.gov/ps/ddwem/publications/waterrecycling/index.htm>

<http://www.epa.gov/ogwdw/standard/pp/treatpp.html>

<http://www.epa.gov/safewater/>

MISCELLANEOUS REFERENCES

http://www.ksg.harvard.edu/visions/performance_management/selected_readings.htm

http://www.cwp.org/Resource_Library/Restoration_and_Watershed_Stewardship/stream.htm

<http://www.cbrc.org/2003speakerpapers/Munoz%20and%20Aguilar%5B1%5D.v1%20for%20web%20site.pdf>

<http://www.on.ec.gc.ca/solec/indicators2000-e.html>

<http://mpsl.mlml.calstate.edu/swdownlds.htm>

http://www.swrcb.ca.gov/swamp/docs/wqindicators_considerations.doc